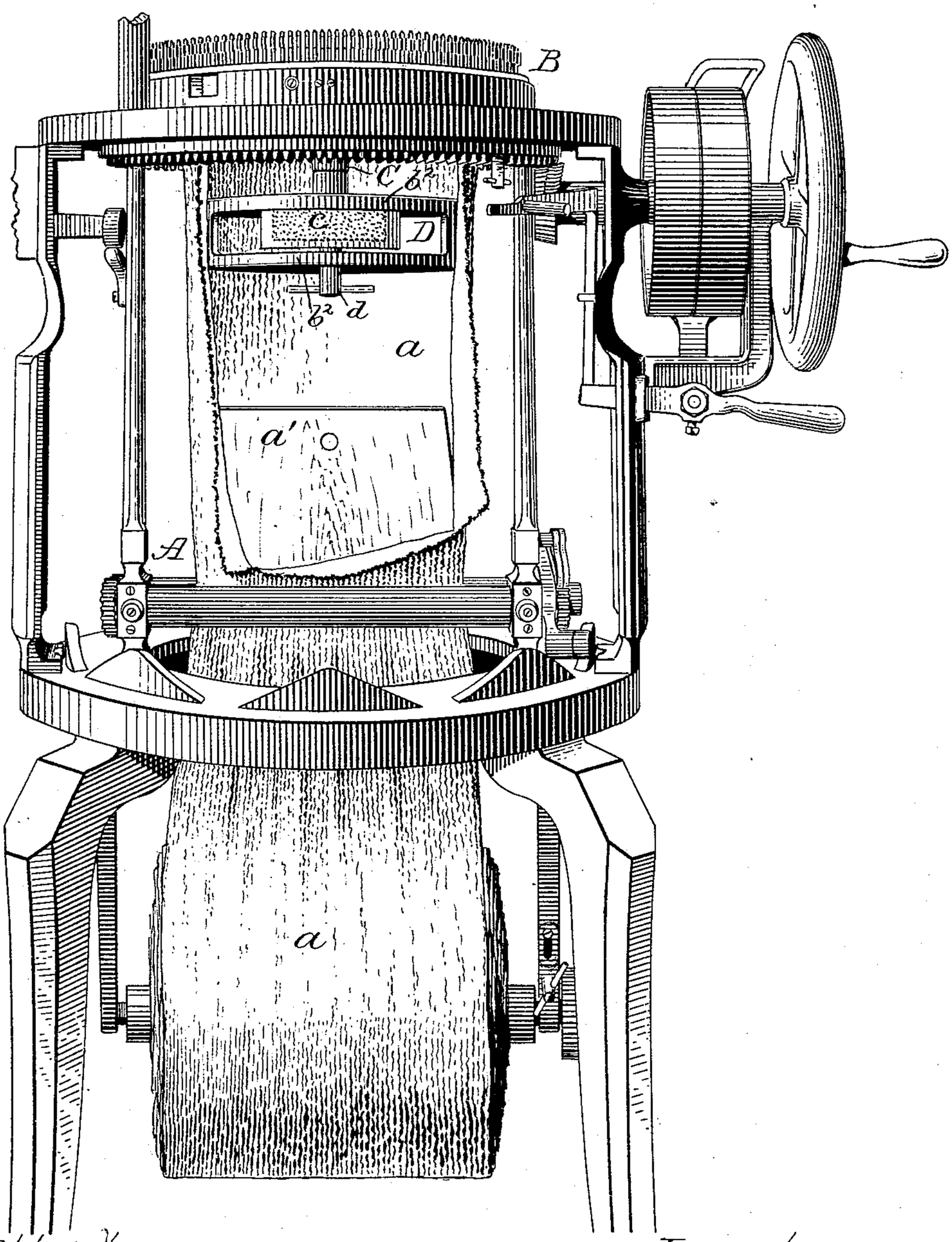
(No Model.) 4 Sheets—Sheet 1.

D. McGENNISS.

DEVICE FOR NAPPING TEXTILE FABRICS.

No. 544,682. Patented Aug. 20, 1895.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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DEVICE FOR NAPPING TEXTILE FABRICS.

No. 544,682. Patented Aug. 20, 1895.

Fig. 2.

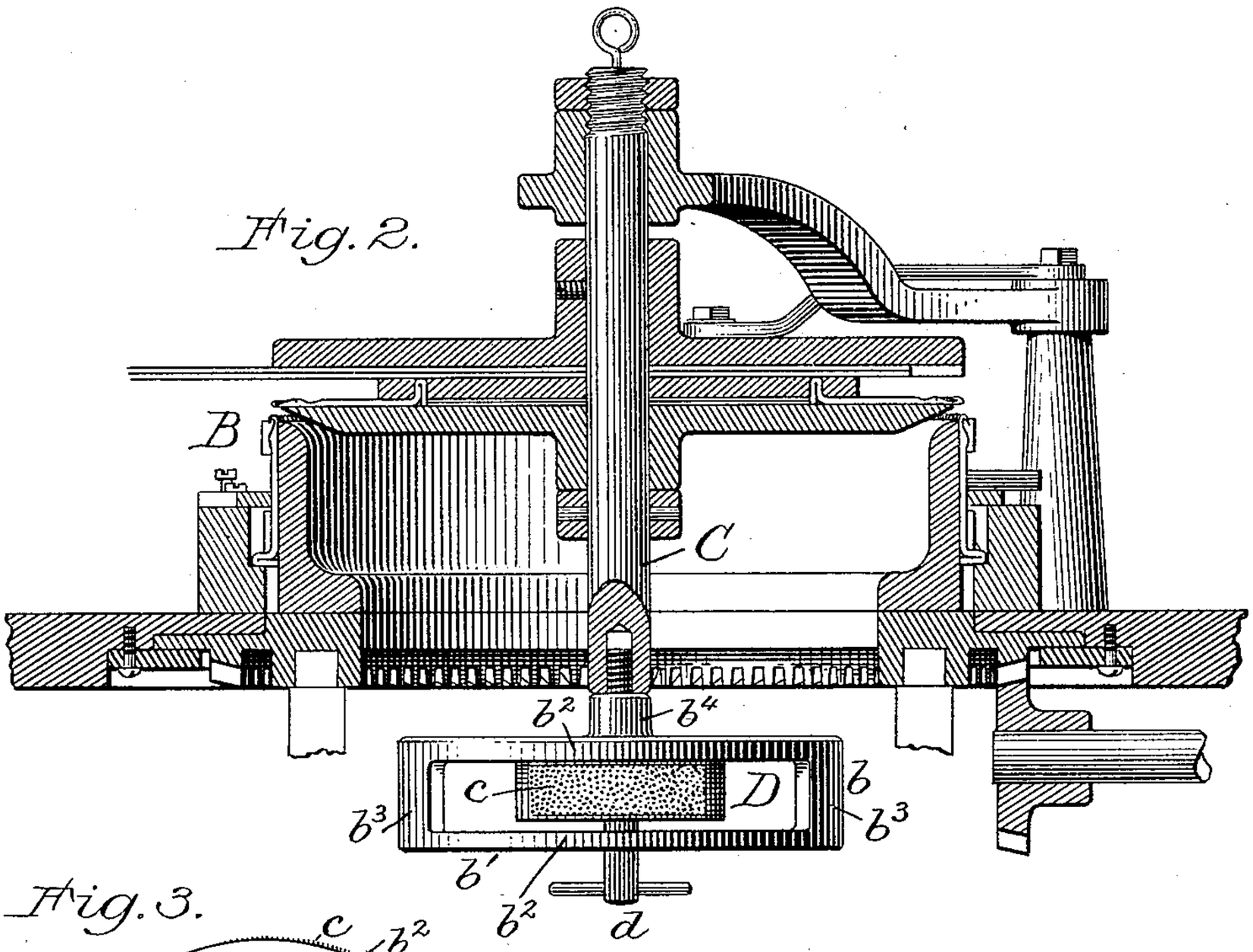


Fig. 3.

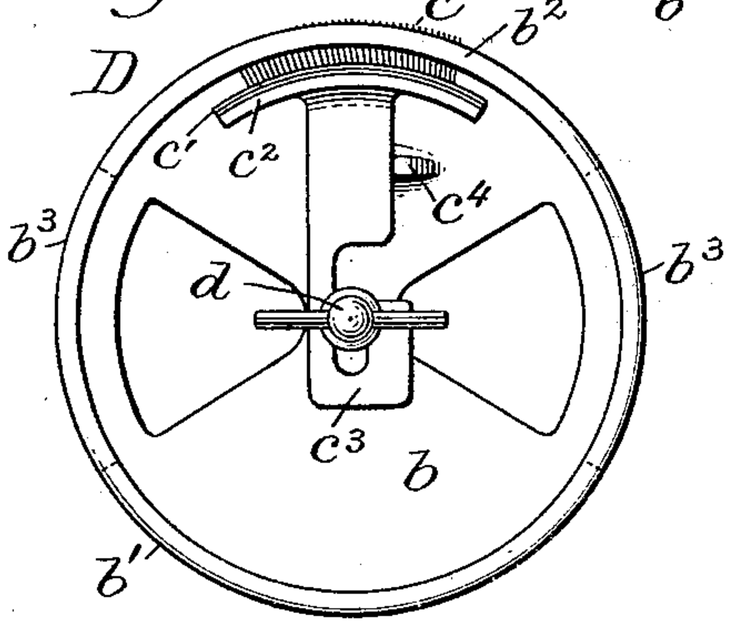


Fig. 4.

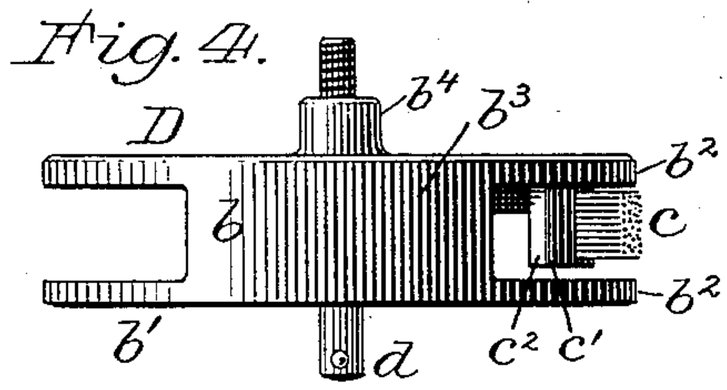


Fig. 5.

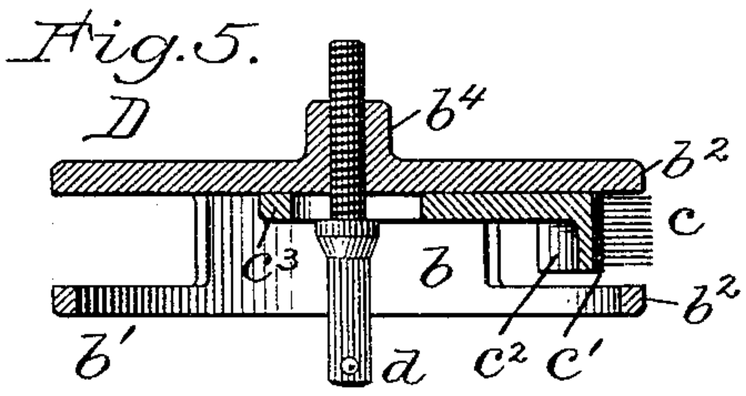
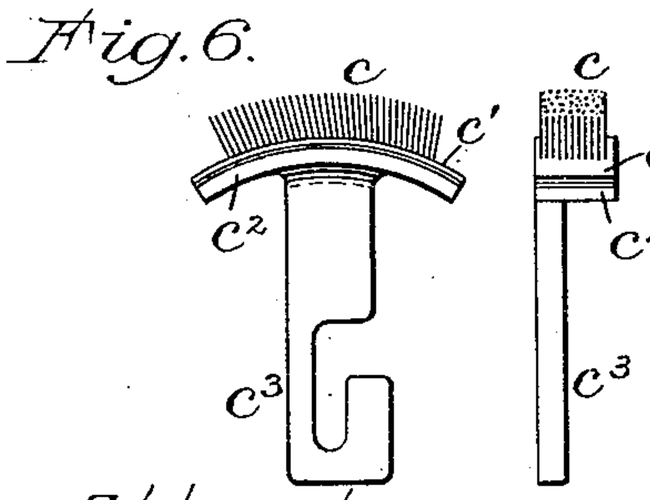


Fig. 6.



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(No Model.) 4 Sheets—Sheet 3.

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DEVICE FOR NAPPING TEXTILE FABRICS.

No. 544,682. Patented Aug. 20, 1895.

Fig. 7.

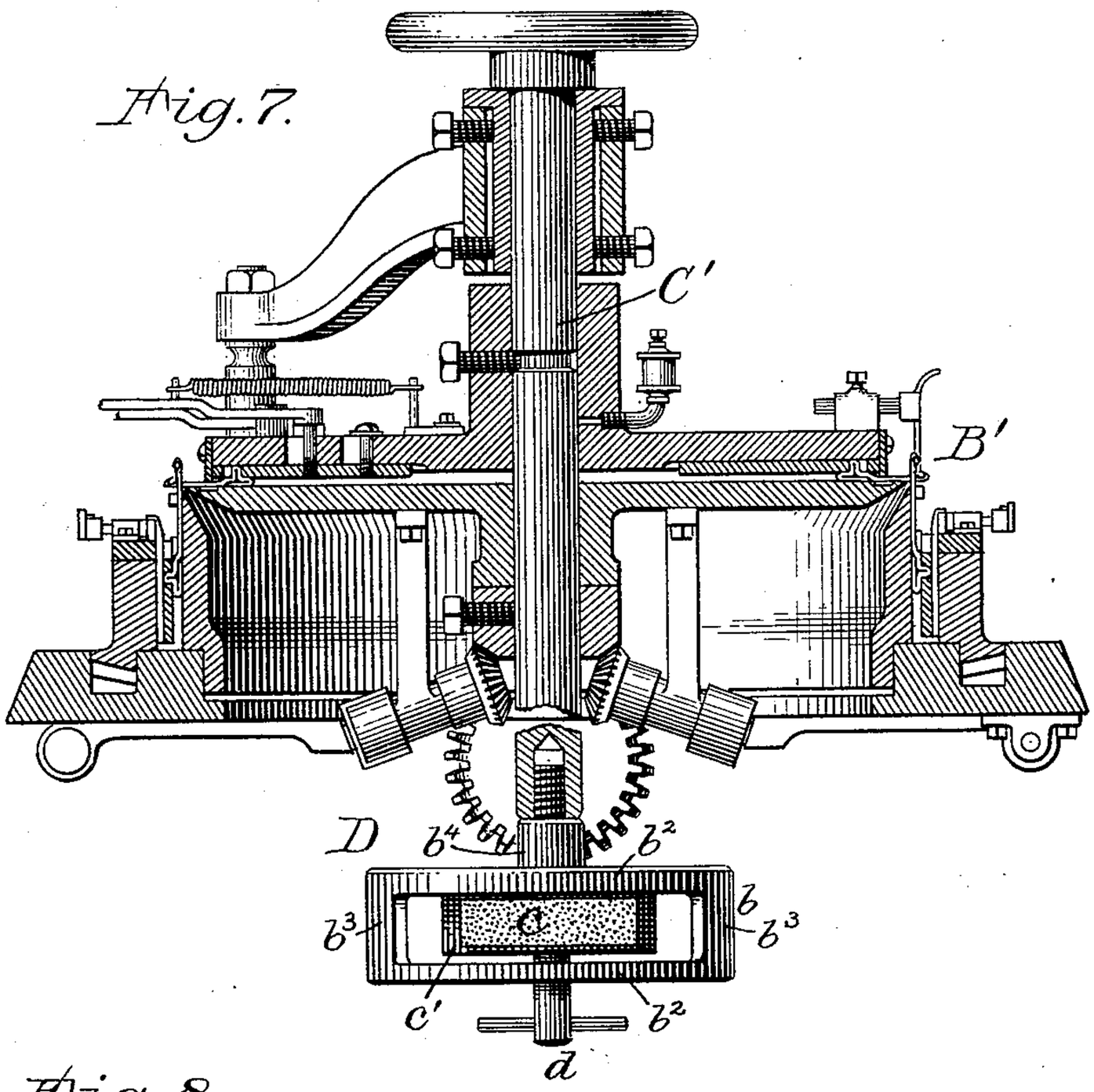


Fig. 8.

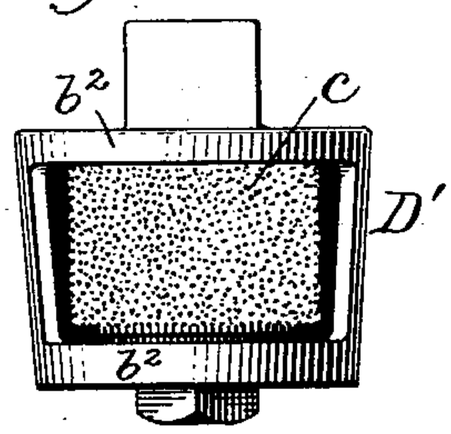


Fig. 9.

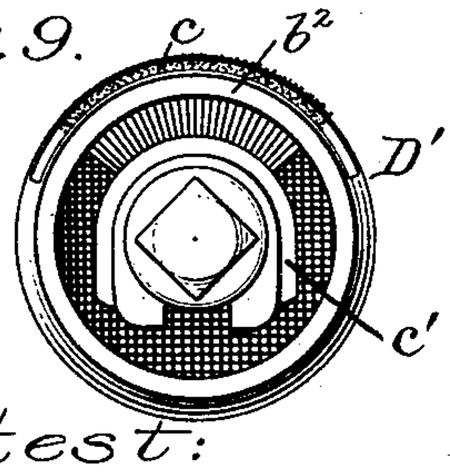


Fig. 10.

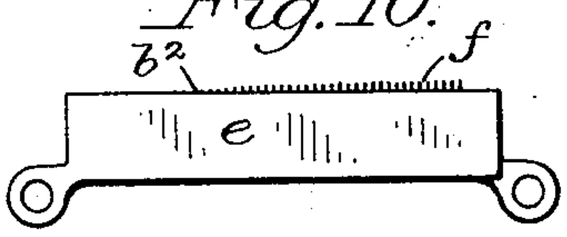
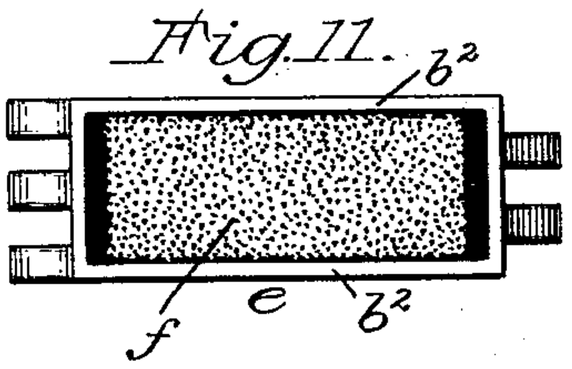


Fig. 11.



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(No Model.) 4 Sheets—Sheet 4.

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DEVICE FOR NAPPING TEXTILE FABRICS.

No. 544,682. Patented Aug. 20, 1895.

Fig. 15.

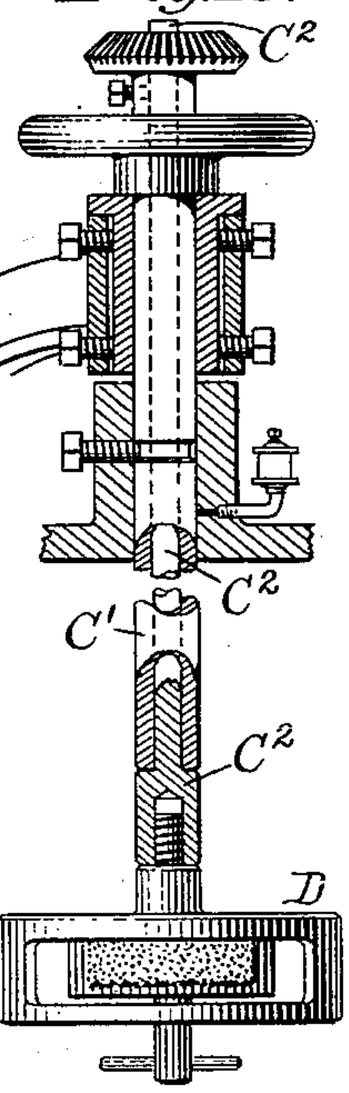


Fig. 12.

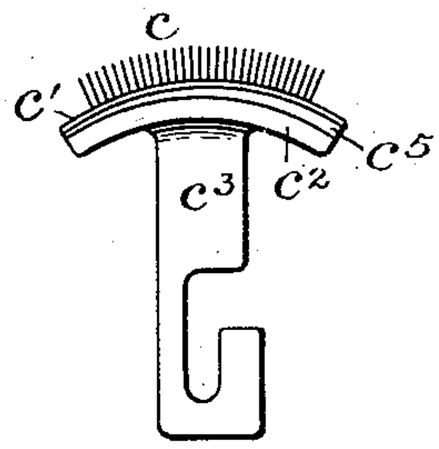


Fig. 13.

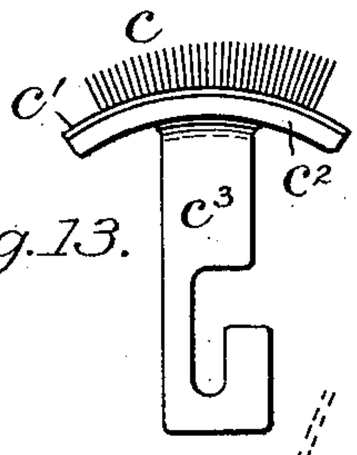


Fig. 14.

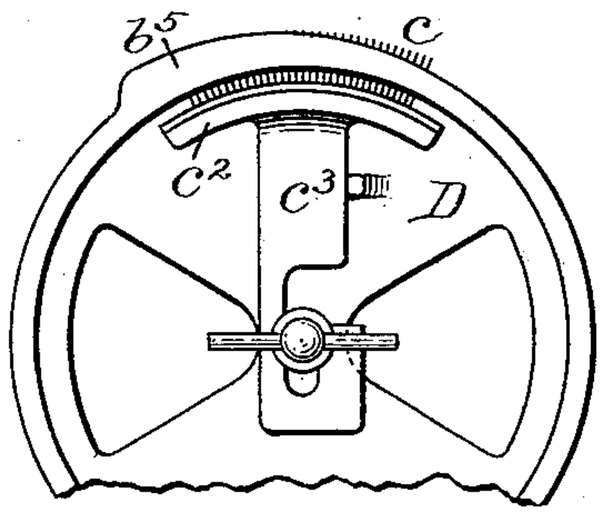


Fig. 16.

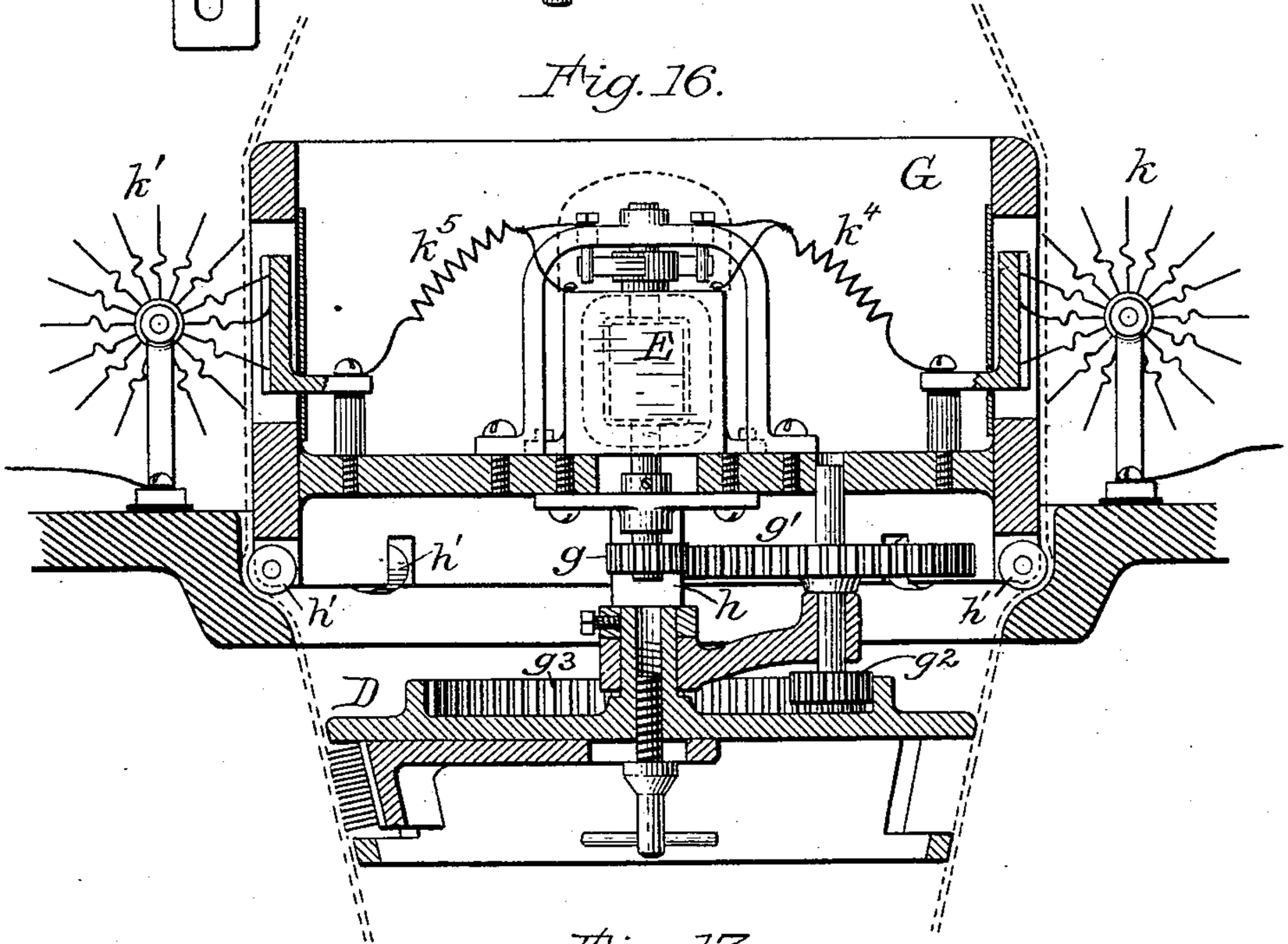
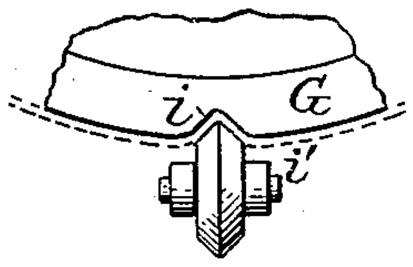


Fig. 17.



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UNITED STATES PATENT OFFICE.

DAVID McGENNISS, OF AMSTERDAM, ASSIGNOR OF ONE-HALF TO GEORGE W. POTTER, OF NEW YORK, N. Y.

DEVICE FOR NAPPING TEXTILE FABRICS.

SPECIFICATION forming part of Letters Patent No. 544,682, dated August 20, 1895.

Application filed November 7, 1893. Serial No. 490,315. (No model.)

To all whom it may concern:

Be it known that I, DAVID MCGENNISS, of Amsterdam, in the county of Montgomery and State of New York, have invented certain new and useful Improvements in Devices for Napping Textile Fabrics; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of my invention.

Although my said improvements involve considerable variation as to their mode of application in and to the general service of napping textile fabrics, their prime value will be realized in organizations for developing a napped surface on tubular fabrics, and especially such as are produced upon circular-knitting machines.

The main feature of my invention essentially includes means of some kind for delivering and also for "taking up" a tubular fabric, and also one or more suitable napping or gigging brushes or cords, which are mounted on a circular carrier and so organized with reference to the circular path of the fabric on its way from the delivering to the "take-up" mechanism that the brushes as a whole will be circumferentially inclosed by and engaged with the interior surface of the tubular fabric to be napped, thus not only providing the said interior surface with a napped finish, but also removing therefrom such motes and burrs as are liable to be present, and also favorably operating upon interior yarn, knots, &c.

So far as my knowledge extends no prior napping mechanism has been so organized as to operate upon the interior surface of a tubular fabric of any kind, although many machines have been devised for napping the exterior or outer surfaces of such fabrics, whether said surfaces were the normal outside surfaces or the normal inner surfaces made accessible by turning the fabric inside out. It is to be understood that the means employed for delivering the tubular fabric to the interior napping teeth or brushes, as well as the take-up mechanism, can be widely varied without departure from the main feature of my invention, and also that it is immaterial whether the napping brush or brushes are stationary or movable elements, so long as means are provided for securing a brushing contact as between the fabric and the brush, it being well known that some prior organizations of delivering and take-up mechanism operate in rotating the tubular fabric, in which case the napping brushes may be stationary, while in other organizations the fabric is not rotated, and hence the napping-brushes must be rotatively driven, although good results would in some cases accrue if the brushes and the fabric were both rotated and in opposite directions.

In certain prior napping-machines for operating upon the outer surface of a tubular fabric means for delivering the fabric and a take-up mechanism have been employed, which in respect of always maintaining a portion of the fabric under tubular distension is not materially unlike the delivery in tubular distension of tubular fabrics during their progressive development as when produced upon any of the well-known forms of circular machines, this tubular-distension delivery being quite the same whether the fabric be continuously rotated or not rotated at all during its formation.

An instance of the particular type of prior napping-machines referred to for operating upon the outer surface of tubular piece-goods is afforded in United States Letters Patent to C. and I. Tompkins, No. 140,320, dated June 24, 1873, and although in such machines the tubular fabric does not rotate, and no means are therein afforded for mechanically driving a napping brush or brushes inclosed within the tubularly-distended fabric, this would be by me provided for by relying upon the circular spreading-ring for supporting the napping-brushes and their carrier, and an independent motor, as will be hereinafter further indicated. Machines of the class thus referred to operate with a line of napping action crosswise of the length of the tubular fabric, and prior napping organizations for operating upon the outer surface of tubular fabrics progressively, or as fast as the fabrics were produced on suitable machines, have been arranged to operate with a line of napping action both parallel with and crosswise of the length of the fabric, the best results accruing from this latter mode of operation.

When a napping device is employed, as by me, with machines capable of producing tubular fabrics, and which essentially include means for delivering and taking up the fabric, the napping device may be deemed an attachment to the producing-machine, and it is in this connection that the main feature of my invention will afford the best economic results.

Whether the main feature of my invention is employed as a napping attachment to any machine capable of producing tubular fabrics, or in a machine organized solely for napping tubular fabrics, its operation is, as before indicated, radically unlike that of any other, in that my napper operates within the fabric and upon the inner surface thereof. I have also organized the teeth of the napping-brushes in masses or groups, with adjacent gaging-surfaces for contact with the fabric, and so that said surfaces prevent undue engagement of the fabric with the teeth, this organization being novel in that the gaging-surfaces are alongside of the edges of the masses, strips, or groups of napping-teeth and parallel with their line of operative or napping action, whether the brush or mass of teeth be movable or stationary. This feature of my invention is specially valuable in napping, gigging, or fleecing goods which are very elastic or stretchy, and whether the goods are tubular or flat, and whether the napper is organized to operate inside of a tubular fabric or outside thereof, and whether the napper is cylindrically organized or in the form of an endless band, belt, or jointed chain. The nearest approach to this portion of my invention of which I have any knowledge will be found in certain old napping-cylinders, (for operating on ordinary flat fabrics,) and wherein longitudinal rows or masses of napping-teeth intervene between longitudinal bars, said bars and rows of teeth being parallel with the axis of the cylinder and extending from end to end thereof. In said prior napping-machines the bars served as gaging-surfaces, but in each instance they supported the fabric crosswise of the line of operative or napping action of the teeth, and my napping device has similar fabric-supporting surfaces, but in addition thereto it has gaging-surfaces which are parallel with the line of operative or napping action by the napping-teeth. In other words, to embody this feature of my invention in said old napping-cylinder the strips or rows of napping-teeth would be segmental in form and arrangement, and between them there would be segmental bars, while between the ends of the segmental masses of teeth (in each circumferential line) there would be surfaces which would be similar in their operation and effect to the surfaces of corresponding portions of the old longitudinal bars.

Still another feature of my invention consists in having the napping-teeth gradually varied in their projection beyond the gaging-surfaces, as from one end of the brush to the other, thus providing for a gradually-varied contact of the fabric with the teeth.

After fully describing my improvements as embodied in various forms and illustrated in the drawings, the several features of my invention will be duly specified in appropriate clauses of claim hereunto annexed.

Referring to the drawings, Figure 1 illustrates so much of one kind of circular-knitting machine as is deemed essential for present purposes and having my napping device applied thereto, and also having a portion of the tubular fabric cut away at one side for disclosing the presence of the napper around which the tubular fabric is rotated. Fig. 2 illustrates in diametrical section the head of the machine, Fig. 1, and the napping device in position for service. Figs. 3, 4, and 5, in bottom, side, and sectional views, illustrate the napping-brush and its carrier. Fig. 6, in side and edge views, illustrates a napping-brush and its holder detached from the carrier. Fig. 7 illustrates in section the head of a knitting-machine in which the tubular fabric is not rotated, with the napping device arranged to rotate within the fabric. Figs. 8 and 9, in side and bottom views, illustrate one of my small nappers for use within tubular fabrics of small diameter. Figs. 10 and 11 illustrate in two views a napping-brush and its carrier embodying certain features of my invention and adapted to operate as a portion of an endless band or belt against the outer surface of a fabric. Fig. 12 illustrates the variable mounting of a napping-brush on its holder by means of a wedge-shaped backing. Fig. 13 illustrates a napping-brush having teeth which are gradually varied in length. Fig. 14 illustrates a brush on a carrier which at its periphery has an eccentric outline affording gaging-surfaces. Fig. 15 illustrates the employment of a hollow central spindle containing a driven shaft carrying the napping device. Fig. 16 illustrates the application of a motor within a napping-machine for operating a napping device within a circular fabric. Fig. 17 illustrates a portion of the spreading-ring of the machine, Fig. 16, and a wheel which prevents the rotation of said ring.

Referring to Fig. 1, it is to be understood that in this machine the take-up mechanism A takes up the tubular fabric *a* longitudinally as fast as it is delivered from the head B of the machine, and that the fabric is rotated during its progressive formation, all in a manner well known. The usual flat spreader *a'* is located within the fabric above the rolls of the take-up.

Next, referring to Figs. 1 and 2, it is to be understood that this machine has the usual vertical stationary shaft-rod or spindle C, centrally located in the circular head B of the machine, said head including the knitting devices usual in this type of machine. When considered as factors in the combination which constitutes the main feature of my in-

vention, the cam-ring and the needle-ring, with the co-operating needles and cam-plate and their operative mechanism, constitute means for delivering a tubular fabric to the take-up, and between which and the take-up the novel wrapping device D is fixedly located on the spindle C and caused to progressively operate in napping the interior surface of the tubular fabric by the rotation of the fabric, which is in this instance derived from the delivering mechanism, and by the longitudinal movement of the fabric derived from the take-up the brushing-contact between the fabric and the napping-teeth being thus effected because the napping device is circular and is located within the circular path of the fabric and operates as a circular lateral support for the fabric, because its diameter, as a whole, is somewhat greater than the diameter of the circular path which the fabric would normally follow on its way to the take-up, thus providing for a proper distension and control of the fabric. This napping device D includes a circular carrier *b*, having a peripheral rim *b'*, Figs. 3, 4, and 5, which is cut through laterally at opposite points, affording apertures or spaces occupied by the segmental strips or groups of napping-teeth *c*, which, as usual, have a flexible backing *c'*, of leather or cloth, or both, which is fastened to the curved or segmental surface of an iron holder c^2, Fig. 6, provided with a slotted shank c^3 and secured to the carrier *b* by means of a clamp-screw *d*. The inner end of this screw *d*, Figs. 3, 4, and 5, serves as a means for mounting the carrier on the lower end of the spindle C, which is bored and tapped to receive said screw, all as clearly shown in Fig. 2. At each side of the segmental brushes or masses of napping-teeth there is a gaging-surface b^2, afforded by corresponding portions of the carrier-rim *b'*, and between the groups of teeth other portions of said rim, as at b^3, in part also serve as gaging-surfaces, in that they prevent undue engagement of the fabric with the teeth, or, in other words, they gage the path of the fabric and, with the gaging-surfaces b^2, prevent the fabric from moving inwardly toward and upon the teeth beyond proper requirements. It will be seen that the gaging-surfaces b^2 are parallel with the line of brush action.

The shank c^3 of the brush-holder has an edgewise bearing against a lug c^4 on the carrier, and being longitudinally slotted the teeth can be adjusted to any desired degree of protrusion beyond the gaging-surfaces. The napping or gigging teeth here shown are of the straight variety, these being preferred by me, although the bent forms may be used, if desired, without departure from my invention.

For securing the best results the curved brushing-face of each brush group or mass of teeth is eccentric to the gaging-surfaces b^2, as clearly indicated, and this adjustment can be effected either by swinging the end of the shank of the holder to the one side if the slot therein be a little wider than the diameter of the clamping-bolt, or between the backing *c'* and the curved surface of the holder a tapered strip of leather c^5 may be inserted, as shown in Fig. 13, or the length of the teeth may be so varied as to afford the eccentric surface, as shown in Fig. 13; or, inasmuch as knitted fabrics are very elastic, and when under tensile strain will readily hug closely against the rim of the carrier, said rim at those portions which afford the gaging-surfaces b^2 could be so shaped as to afford the desired eccentric outline, as shown at b^5 in Fig. 14, so that even if the face of the strip of napping teeth occupied the arc of a circle the gradually-increased projection of the teeth (from one end of each segment to the other) beyond said surfaces would be fairly well provided for, although it will be obvious that of all these ways of securing that end the simple adjustment of the holder on the carrier is the best, and moreover this provides for a desirable variation in the angles at which the napping-teeth engage with the fabric.

In all circular machines capable of producing tubular fabrics there is in the circular head a central vertical spindle to which the napping device can be attached and suspended, and hence the combination of those two elements will secure the main ends sought by me, because, whether said spindle be non-rotative or rotative, it is always in line with the center of the circular path of the tubular fabric on its way from the producing or delivering mechanism to the take-up, and in each case the delivering and take-up mechanism is appropriately organized either so as to rotate the fabric or not, thus inevitably providing for the brushing contact as between the napping-teeth and the fabric.

It will be readily seen that longitudinal pulling strain on an elastic tubular fabric, due to the take-up, causes the fabric to bear inwardly with uniform pressure upon or against the several gaging-surfaces, and therefore the action of the napping-brush must be uniform and that it will be practically impossible for the fabric to be injured by the napping-teeth.

Now on referring to Fig. 7 it will be seen that it illustrates the head B' of a machine of that well-known type in which the central spindle C' revolves, and as the fabric is not rotated the take-up (not shown) merely draws the fabric downwardly as fast as it is delivered from the head, all in a manner too well known to require special illustration in this connection.

The central spindle as ordinarily employed in any knitting-machine would be too short to enable the napping device D to be located sufficiently low to properly occupy the circular path of the fabric on its way to the take-up, and therefore either a new and longer spindle would be required in a machine or the carrier should have a longer hub, as at b^4, and a longer clamp-screw *d*, thus in sub-

stance providing for an elongation of the spindle. When thus organized, the napping device is rotated and the desired brushing contact of the teeth and the interior surface of the fabric is attained. I am, of course, aware that either of these spindles could be in tubular form and arranged to receive a second spindle, to which the napping device might be attached, and that in the case of the machine, Figs. 1 and 2, this second spindle would enable the napper to be rotated in a direction opposite to that in which the fabric would rotate, and also that in the case of the machine, Fig. 7, the second or inside spindle would enable the napping device to be operated in either direction and at a speed greater or less than that at which the spindle C′ would usually be revolved; but it will be obvious that such variations would involve no departure from the gist of the main feature of my invention, because machines with such spindles would involve the employment in an appropriate combination of a napping device located within the circular path of the tubular fabric during its progress from the delivering mechanism to the take-up. Such an organization of a separately-driven spindle is illustrated in Fig. 15, wherein the spindle C′ is hollow and does not carry the napping device D; but otherwise said spindle is precisely as in Fig. 7. Within this hollow spindle is the driven spindle C^2, which carries at its lower end the napping device D, and said driven spindle is geared at its upper end, as shown, for enabling it to be operated independently of the hollow spindle.

As hereinbefore indicated, the main feature of my invention is applicable to napping-machines of the Tompkins type, which have heretofore been restricted in their capacity to napping the exterior surfaces of tubular fabrics, and inasmuch as such machines operate on piece-goods of various lengths my napping device must be operated by an independent motor of some kind.

Among various obviously-applicable motors I have selected for illustration, in Fig. 16, an electric motor E, which is supported on a platform within the spreading-ring G and is coupled by spur-gears g, g', and g^2 to the napping device D, which, at the top of its rim, has an internal gear g^3. The napping device D is suspended from and has its axial bearing in a cross-arm h, attached to the spreading-ring G, the latter being supported on friction-rolls, as at h', and secured against rotation by means of a vertical groove i in its outer surface, occupied by a suitable controlling-wheel i', as illustrated in Fig. 17, the fabric passing freely downward between the wheel and the spreading-ring. Electric energy is supplied in a well-known manner by way of the outside star-wheel conductors k k', the flexible arms of which freely penetrate the fabric (indicated in dotted lines) and electrically engage with the interior grooved contact-plates k^2 k^3, which are connected with the motor E by conductors k^4 and k^5. With an electric organization due care should be taken to protect all of the contacts from flying lint, and so also should undue weight be avoided. The power required for operating the brushes being quite light, moderate electric currents will be sufficient for my purposes.

It will of course be understood that in machines of the Tompkins type a roll of tubular piece-goods is located above the machine and drawn downwardly over the spreading-ring G, and from thence it passes to the usual take-up, which operates the same as in such machines as produce tubular fabrics without rotating the fabric.

It will be understood that for operating on tubular fabrics of small diameter the napping devices must sometimes be quite small, in which case the form of the carrier and holder is somewhat modified, as shown, for instance, in the napping device D′, Figs. 8 and 9, wherein a single mass of napping-teeth c is employed, with the gaging-surfaces b^2 at each side of the mass. Small brush-carriers are preferably frusto-conical in form, as indicated in this instance.

In certain prior napping attachments to circular-knitting machines the napping-teeth have been carried on endless belts and caused in some cases to traverse the outside surface of the fabric when the latter was not rotated and in other cases to remain stationary, as when the fabric is rotated. In Figs. 10 and 11 I show in two views a section of a napping chain or belt embodying two of the features of my present invention. Each section e is provided with suitable ear-lugs at its ends for enabling them to be coupled or hinged together, and the strip f of napping-teeth is bounded on its two sides by the gaging-surfaces, as at b^2, and the brushing-surface of the napping-teeth, lengthwise of the strip, is inclined with reference to the gaging surfaces, as clearly indicated in the side view, Fig. 10, and said surfaces are parallel with the line of napping action as in the circular form of napper.

Although the napping devices may be and are applied by me to knitting-machines in the manner described, it will be obvious that with respect of the napping operation the means by which the fabric is produced are immaterial so long as they also serve as means for delivering tubular fabric to the napping device during the progress of the fabric to the take-up.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination substantially as hereinbefore described, of "take-up" mechanism adapted to receive a tubular fabric; means for delivering tubular fabric to said "take-up;" a napping device located within the circular path of the tubular fabric on its way to the take-up, and means for securing a brushing contact between the interior surface of

the fabric and napping device, the organization being such as to progressively develop an interior napped surface on the fabric during its progress toward the take-up mechanism.

2. The combination with a machine for producing a tubular fabric, provided with a suitable take-up, of a napping device supported centrally within the circular path progressively occupied by the produced tubular fabric on its way to the take-up, substantially as described.

3. In a machine for producing tubular fabrics, the combination substantially as hereinbefore described, of a vertical spindle centrally located within the head of the machine, and a napping device axially mounted upon the lower end of said spindle.

4. In a machine for napping the interior surfaces of tubular fabrics, the combination substantially as hereinbefore described, of means for delivering and for taking up said fabric, an annular spreading or distending rim, adapted to operate within the fabric, and napping teeth adjacent to said rim, and adapted to operate within said fabric and upon its inner surface, the said rim affording gaging surfaces for the fabric in the line of napping action, for controlling the path of the fabric over the teeth, on its way to the take up.

5. In a napping device, the combination substantially as hereinbefore described, of gaging surfaces, and a mass or group of napping teeth gradually varied as to their projection beyond said gaging surfaces from one end of the mass to the other, and affording a brushing face which will engage in gradually varied contact with the surface of fabric to be napped.

6. In a napping device, the combination substantially as hereinbefore described, of a circular brush carrier having at its rim open spaces surrounded by gaging surfaces for contact with the fabric to be napped, and a segmental brush consisting of a group or mass of napping teeth and a holder therefor which is adjustably mounted on said carrier for locating the group of napping teeth within the open spaces, and enabling a varied adjustment of said teeth with relation to said gaging surfaces.

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